Professor Karl Pearson; but they have not been seriously shaken, so far as I know." Here is a point where a more detailed consideration would have been in place. We do not know whether Mendelism has received careful study, and has been rejected as unreliable, or whether the writer has failed to follow recent developments in the theory of hereditary transmission. On the subject of Eugenics we read: "its first object is to check the birth-rate of the Unfit, instead of allowing them to come into being, though doomed in large numbers to perish prematurely. The second object is the improvement of the race by furthering the productivity of the Fit by early marriages and healthful rearing of their children. Natural Selection rests upon excessive production and wholesale destruction; Eugenics on bringing no more individuals into the world than can properly be cared for, and those only of the best stock."——

Sir Francis Galton belongs to a vanishing type of workers in science,—men of high native ability and independent fortune, who devote themselves to the advancement of knowledge and its application in the public service from an intrinsic interest and a keen sense of public duty. Charles Darwin, his near kinsman, is perhaps the most conspicuous instance of the type, which .indeed has always found its principal representatives in Great Britain. The vast accumulation of scientific observations in recent years, and the necessity of a technical training to cope with it, have now brought the specialist to the front in all intellectual concerns; and the amateur, however gifted, must in the future be content to take a lower place. It is not likely that our author will have successors. All the more should we be grateful for this outline of his life and labors; all the more should we pay our free homage to one who, without the responsibilities of an official position, did yeoman's work on behalf of the struggling science of experimental psychology. TH. WALTERS.

Fifty Years of Darwinism: Modern Aspects of Evolution. Centennial Addresses in Honor of CHARLES DARWIN before the American Association for the Advancement of Science, Baltimore, Friday, Jan. 1, 1909. New York, Henry Holt & Co., 1909. pp. v., 274.

This volume, the nature and object of which are sufficiently indicated by its title, contains ten addresses and a brief introduction. The Introduction, written by Prof. T. C. Chamberlin of the University of Chicago, the president of the American Association for the Advancement of Science, points out the influence that the thought of Darwin has exerted and still exerts upon the work of the Association. "In the first decades of the great Darwinian movement in biology, the tribute of our members may not have been wanting in demonstrations of the force of old adhesions, but even then, whether by resistance or by co-operation, we gave our testimony to the new power that made itself felt in the scientific world. A little later, we paid the tribute of conviction—the general tribute of willing conviction, on the part of some of us, and the even more significant tribute of reluctant conviction, on the part of others; but, in one way or another, we paid a universal tribute." The continuance of this influence is attested by the following addresses.

Professor E. B. Poulton, Hope professor of entomology at Oxford, opens the series of special papers with a review of Fifty Years of Darwinism. We cannot mention all the points, biographical, appreciative, critical, controversial, made by Professor Poulton in the course of his address. We notice only his strong insistence on the influence of Sir Charles Lyell, the geologist, upon Darwin's mind; his hardly qualified rejection (p. 40), as against Francis Darwin, of

the doctrine of the hereditary transmission of acquired characters; his emphatic statement of Darwin's conviction, after prolonged study of mutations, that "it is by the accumulation of extremely slight variations that new species arise," that evolution is continuous and not discontinuous; and his defence of natural selection against the charge that it "descended like a numbing spell" upon studies of hybridism. It is interesting to read (footnote, p. 22) that Adam Sedgwick attacked the *Origin* on the ground that it "utterly repudiates final causes." Huxley, too, thought that it had banished teleology from biological science. The event has proved that, on the contrary, it threw the doors only too wide open for facile explanations in terms of end.

Professor J. M. Coulter, of the University of Chicago, next discusses The Theory of Natural Selection from the Standpoint of Botany. Two points are given special emphasis: the prevalence of non-adaptive characters, and the inadequacy of natural selection to account for the great changes in the phylogenetic series. Botanists are forced to see in a very large number of structures "inevitable responses to conditions that have nothing to do with adaptation. . . . Natural Selection does not select individual plants on the basis of some small and better adapted variation, and so build up a character, which with its associates will gradually result in a closely allied new species; but . . . its selection of individuals seems to hold no relation to their useful characters. On the other hand, . . . Natural Selection determines what species shall survive, simply by eliminating those that do not." The principle still, therefore, has an important place, since "the species that survive determine, within limits, the species to be produced." But it is inadequate to account for "the establishment of the assemblages of different characters that distinguish great groups"; for the study of phylogeny shows that these "have been wrought out by steady and progressive change through all imaginable changes of environment"; the evolution of Gymnosperms is cited in evidence. On the whole, then, Professor Coulter's paper gives a negative impression, though he grants that Darwin's personal position in plant physiology and ecology is one of the first rank, and that the principle of natural selection came into plant morphology at the psychological moment and served greatly to stimulate investigation.

Dr. D. S. Jordan, president of Stanford University, discourses on Isolation as a Factor in Organic Evolution. "So far as species in nature are concerned, we can account for the origin of none of them, except on the ground of the presence of some forms of isolation. . . . The minor differences which separate species and sub-species among animals and plants, in so far as these are not traits of adaptation (and most of them are clearly not such), owe their existence to some form of isolation or segregation. . . . From difference of parentage, or difference in selection, or from difference in the trend of development, whatever its cause, local peculiarities arise. . . . It may be that change of environment sometimes excites germinal variation. . . . The obvious factor in the splitting apart of races or species is, therefore, in all groups, that of isolation. Behind this lies the primal factor of variation, continuous or discontinuous. . . . With these come the factor of heredity and the factor of selection. . . . Selection alone does not prodnce new species, although it may continuously modify old ones." These quotations sufficiently indicate the line of reasoning pursued in the paper. "In Darwin's view, isolation or segregation was doubtless a feature of Natural Selection." Since Darwin, Moritz Wagner has convincingly shown

the fundamental relation of this factor to the problem of the origin of species.

Professor E. B. Wilson, of Columbia University, treats of The Cell in Relation to Heredity and Evolution. Darwin's doctrine of pangenesis involved two principal postulates: the particulate assumption that particular hereditary traits are represented in the germ-cell by discrete and specifically organized particles, capable of self-perpetuation without loss of specific character; and the assumption that these gemmules or pangens are cell-germs originally produced by the somatic cells. The first of these postulates has been adopted and worked out, notably by Weismann; but it is so far unverified, and probably unverifiable. The second is unsupported by experimental or cytological evidence; we must accept, in its place, the law of genetic cellular continuity. Four questions then arise. (1) What is the physical basis of heredity? It is probable that the nucleus (the chromatin-substance) embodies the specific primordia of determination. True, there are formative protoplasmic materials; but some of the most important are known to be of nuclear origin, and it is possible that all have that origin. (2) How is it transmitted from cell to cell? By division; and, in most cases, by karyokinetic division. The chromosomes are composed of specifically different materials, the ensemble of which is essential to normal development; and karyokinesis ensures the meristic division and equal distribution of these materials. (3) In what way does it play its part in the determination of the hereditary characters? Chemically: the chromosomes may be regarded as self-perpetuating magazines of specific substances, similar in nature to enzymes or their chemical antecedents, that play an essential part in the determination of the cell-activities, including those involved in development. The fertilization of the egg may almost be compared to an intracellular injection of enzymes. This view squares admirably with the Mendelian view of heredity. (4) How may it be so modified as to give rise to new heritable characters? Both body-cells and germ-cells react to physico-chemical changes of the environment by definite physiological and morphological changes; such modifications of the germ-plasm produce blastogenic variations or mutations that are inherited, permanently or temporarily. In this way we can account for direct influence by invironment, fluctuating variations, mutational variations, particulate mutation, orthogenetic transformation,—for everything, in fact, but the transmission of acquired characters.

Dr. D. T. MacDougal, of the Carnegie Institution of Washington, writes upon The Direct Influence of Environment. We know that secondary effects of the action of external factors, or of morphogenic or embryonic procedure, may be freely communicated in the plant from part to part of the soma, and from the egg to the soma. May inheritable effects be communicated from the soma to the egg or sperm? (1) The character of the building material supplied to the egg, as varied by environmental influences, may work changes that pass from generation to generation. (2) Repetition of stimuli in a series of generations, so far as examined, is effective for heredity only when the germ-plasm has been acted on simultaneously with the soma. It is, however, difficult to induce bodily changes without affecting the reproductive elements; and the attention of biologists has therefore turned toward modification of egg or sperm alone. They have studied the influence of changed climatic conditions, of radiations, and of chemical solutions, and in every case have found that individually acquired or induced characters may be transmitted from one generation to another practically unchanged. Neverthe-

less, the case against the transmission of purely somatogenic characacters is not closed: the physiological mechanism would permit it; experiments on the action of external agencies upon the soma exclusively have hardly yet been seriously attempted; and certain adaptive correlations of organs, found in nature, distinctly suggest it. Coming back to the work on the germ-plasm, we must refer the inherited changes to departure from normal mitotic procedure or to disturbance of the autolytic action of the cell. The changes themselves were in some cases discontinuous (mutations), in others continuous (fluctuations). Some, again, consisted in increase or loss of existing capacities; others in the acquisition of characters new to the genus. The processes thus "disturbed or set in motion" appear to be "identical with some of those concerned in the main evolutionary development of organisms."

In the next address, on The Behavior of Unit Characters in Heredity, Professor W. E. Castle of Harvard University shows, by reference to the color-varieties of rabbits, the nature and influence of Mendel's unit characters. He traces the advance of Mendelism in recent years, and indicates some of its problems. He concludes that, "fragmentary as our present knowledge is, it is doubtful whether any category of organs, quantities, or parts, can be mentioned which is not subject to Mendelian inheritance." The style, clear and straightforward, is in pleasant contrast to the involved Latinism of the preceding paper.

Mutation is handled by Dr. C. B. Davenport, of the Carnegie Institution of Washington. "The mutation theory rests on the doctrine of unit characters and applies only so far as that doctrine applies." Darwin recognized saltation, especially in the *Variation under Domestication;* but he emphasized quantitative or fluctuating variation in the *Origin*, because he was there championing the continuity of nature as against the doctrine of special creation. Mutations have now been studied both in nature and under domestication. (1) The selection of fluctuations and their summation bring an improvement that (as Darwin himself recognized in certain cases) ceases after a few generations; the fortunate sport is then the centre from which further progress must start. (2) Mutations are subject to natural selection; even so close a case of adaptation as that of the leaf-butterfly may arise by a series of mutations (Bateson); and mutations may become adaptive by their possessors selecting a habitat that fits their organization. (3) The doctrine of mutation explains the swamping effect of inter-crossing, and the discontinuity between species. There may, no doubt, be cases of graduated development of unit characters, all the way from invisibility to strong expression; but for the present we shall do best to assume their normal discontinuity.

After Mutation comes Adaptation, which is discussed by Professor C. H. Eigenmann of the University of Indiana. An organism consists of adaptive characters, of vestiges (remnants of past adaptations), and of non-adaptive characters, that may perhaps be past adaptations or may become adaptive in the future. If we confine ourselves to the adaptive characters, two questions arise: that of the origin of adaptive faunas, and that of the origin of adaptations. The first is answered, in general terms, by reference to selective migration; suitable habitats are sought by species that are already, in the large, adapted to them. The second is far more difficult to answer. The author bases his treatment of it upon observations of the freshwater fishes known as Characins, and comes to the following conclusions. (1) The Characins furnish evidence both for orthogenesis

and against its universality. (2) There is evidence both of mutation and of fluctuation. (3) Transmissible adaptations undoubtedly arise as the result of peculiarity of environment. Three ways are possible: use-transmission, direct affection of the germ-plasm, realization of nascent adaptive capacities. The latter must be ruled out, however, in the case of the bleaching of cave-animals. (4) Do transmissible variations arise as the result of functional adaptation? Apparently they do (progressive degeneration of the eyes of cave vertebrates), although the evidence has not so far carried general conviction. Further work, experimental, observational and systematic, is needed for the solution of this problem of problems, the origin of adaptations.

In the following paper, on Darwin and Paleontology, Professor H. F. Osborn, of Columbia University and the American Museum of Natural History, hails Darwin as, in succession to Cuvier, the second founder of paleontology. Darwin's view of the operation of natural selection is either confirmed or untouched by paleontological discoveries. On the other hand, the geological record shows clearly that new characters do not originate by selection of the fit from the fortuitous; "the law of gradual change in certain determinate, definite, and at least in some cases adaptive directions, through very long periods of time, and the absence of chance or non-direction in the origin of a large number of adaptive and other new characters, is the common working principle both in vertebrate and invertebrate paleontology." This law is not subversive of the doctrine of mutations; the paleontologist is favorably situated for the observation of continuous, unfavorably for that of discontinuous evolution; the question of mutation or fluctuation must be settled elsewhere. The law asserts, however, that certain origins are adaptive in direction from the beginning; and this 'principle of rectigradation' introduces a factor unknown to Darwin. Its causation is at present obscure. Use-transmission either fails to explain or proves to be unnecessary in explanation, though it should not yet be finally abandoned. The causation lies, probably, in the domain of heredity rather than in that of ontogeny, environment or selection; in view, however, of the inseparableness of internal and external processes, the initiation of certain adaptive origins may be found in the circle of ontogenetic or environmental causes. The address closes with a review of the method of evolution as exemplified by the Titanotheres.

The concluding chapter of the book, contributed by G. S. Hall, president and professor of psychology, Clark University, is entitled Evolution and Psychology. It first makes the point that "Darwin's method is always and everywhere objective and observational, never subjective or introspective." "Emotions are best studied in their outward expressions in gesture, will is investigated in the study of behavior, intelligence by massed instances of sagacity." Conceding the fact that the current, non-evolutionary methods have brought about "a prodigious and sudden horizontal expansion" of psychology, it then affirms that genetic synthesis is both necessary and impending. "Some of us are already convinced that the human soul in all its power is just as much a product of evolution as the body; but our faith needs to add the knowledge that can only come when all the authentic data are properly grouped." The address turns, next, to a consideration of rudimentary psychoses and psychical recapitulation. Consciousness is an epiphenomenon of mind; there are incessant and manifold affective and other processes going on in us that lack consciousness; such states and activities irresistibly suggest past evolutionary stages. "The child is not so much the father of the man as

his very venerable and, in his early stages, half-anthropoid ancestor." Finally, in a forecast of the future, the author predicts the adequacy of genetic psychology to education, religion, psychiatry, and the domain of the unconscious, if only there shall arise a new "Darwin of the mind" to substitute for the pedantry of the schools "the essential facts of life as it is lived out by the toiling, struggling men, women and children, normal and defective, of our day."

P. E. WINTER.

The Eternal Values, by HUGO MÜNSTERBERG. Boston and New York, Houghton Mifflin Company, 1909. pp. xv, 436. Price $2.50.

This work is a modified author's translation of the *Philosophie der Werte*, reviewed in the *Journal*, xix., 1908, 408 f. "Much in this English version is newly added and much is omitted from the previous text. Many side issues, especially such as connected the work with particular German movements, are entirely left out, and not a few additions refer to recent American discussions. Other parts are greatly condensed." The writer's general attitude and manner of treatment are, of course, unchanged.

In my review of the German original I expressed the opinion that the book, notable as the expression of a strongly marked personality, could nevertheless not hope to appeal, vitally and enduringly, to any large body of academic youth. "The next reformation in thought must come", I said, "from within the sciences, not from the external realm of concepts." It is only fair, then, to quote the author to the contrary. "Far beyond the circle of philosophers it was greeted as an expression of the new desires of our time. . . The ethical idealism of the book seemed to touch the most widely different layers of the community." Whether the impression thus made is permanent remains to be seen. At any rate, nothing but good can come of the mental effort of sustained thinking which *The Eternal Values* demands of its reader. "More and more", remarks Professor Münsterberg, "the aim seems to be the writing of philosophy in brilliant epigrams and clever discussions. Especially our younger philosophers dash down their thoughts in an impressionistic style which captivates and does not need the slightest effort to follow. Who will doubt that such picturesqueness is stimulating and attractive? Yet after all it is serving the ultimate purpose of knowledge no better than a picturesque and epigrammatic mathematics or chemistry. Philosophy is a movement of thought which demands the thoroughness of the expert, and which can be followed only with concentrated attention. Everything depends upon inner consistency, and only a closely knit system can secure it. In all times only such systems have marked the great periods of philosophical insight." Saul also, then, is among the prophets; reaction has set in within the precincts of the temple itself. May the reaction prosper!

M. W. WISEMAN

Herbert Spencer. Von DR. KARL SCHWARZE. Mit einem Bildnis Spencers. "Aus Natur und Geisteswelt", Bd. 245. Leipzig, B. G. Teubner. 1909. pp. x., 131. Price Mk. $1.25.

When F. H. Collins published his Epitome of the Synthetic Philosophy in 1889, Spencer himself vouched for the accuracy of the work, and expressed surprise that so much of the original System could be compressed into so small a space. The fact is, however, that Spencer is of all systematic philosophers the easiest to summarize: partly because his thought moved linearly, idea following idea in single file, towards a well-defined goal; partly because, in his endeavor after clearness, he was not sparing of words; and partly also because he knew definitely, in every case, what he wished to convey to the reader.